Home Canning of Fruits and Vegetables

As Taught to Canning Club Members in the Southern States

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THERE ARE CERTAIN ESSENTIALS for the successful canning of fruits or vegetables. These include clean, fresh materials, perfect containers, including good rubber rings if used, heating for sufficient time to insure preservation, and air-tight sealing. These essentials must be secured in any method of canning. The details of procedure may differ, yet all have as their object the prevention of spoilage.

The material in this bulletin presents the practice generally followed in the Southern States and taught in those States by the Extension representatives of the Department of Agriculture. A presentation of practices generally followed in the Northern, Central and Western States and taught in those States by Extension representatives of this Department is contained in another bulletin.

HOME CANNING OF FRUITS AND VEGETABLES.

CONTENTS.

CANNING AND OTHER METHODS OF CONSERVATION.

CANNING has become the most widely used and popular means of preserving large quantities of fruits and vegetables. The original form, flavor, color, and texture of fruits and succulent vegetables are retained to a greater degree by canning than by any other means. For this reason, certain delicately flavored vegetables are most attractive when canned. Another advantage is that canned foods are ready for almost immediate serving. It must be remembered that other means of preserving foods are very desirable, especially during the present season, when conservation of all food products should be practiced. For example, legumes, like lima beans and peas, and root crops, like carrots and beets, while attractive when canned in a succulent stage, are more nutritious and more economically stored when mature. Summer cabbage, cauliflower, and cucumbers are better saved in brine than canned. Other vegetables also can be brined. Many vegetables, such as sweet corn and green string beans, can be dried, and in this stage furnish variety and serve as a substitute for canned vegetables. If properly dried and stored these vegetables are attractive and wholesome. A publication (Farmers' Bul. 841) dealing with drying may be obtained from the United States Department of Agriculture.

This bulletin will deal wholly with methods for canning, preserving, and jelly making. The directions given are chiefly for those products which seem most worth preserving in these ways, and the methods are those which seem best suited to the products.

STERILIZATION.

CAUSE OF SPOILAGE.

Foods decompose or spoil because they are attacked by living germs, minute forms of plant life of the lowest order. Three types of these tiny organisms cause foods to spoil, namely, molds, yeasts, and bacteria. These are present constantly everywhere, in air, water, and soil, and on food. All except molds are so minute as to be invisible without the aid of a microscope, and all exist in teeming millions.

Molds are of first interest because the housekeeper is familiar with their appearance in the growing stage in which they attack foods, and even fabrics, causing rapid destruction. Molds thrive in dampness and darkness and prefer freedom from currents of air. They require oxygen, moisture, and warmth, and feed upon sugar and starches. Since they can grow in the presence of acids, fruit and tomatoes are readily attacked by them. The fruiting parts of molds bear spores which serve the same purpose as seeds of higher plants. These invisible spores are produced in such quantities as to be present in the air at all times, ready to develop upon any foods which are exposed. Molds are killed easily by moist heat. The practice of processing foods in jars and sealing immediately eliminates all trouble with mold.

Yeasts also must be controlled in canning. Yeasts are of many kinds, all one-celled plants, which reproduce by budding, that is, by the growth of a bud on the edge of a cell. This bud quickly becomes full grown and breaks away from the mother cell. Some yeasts have another means of reproduction, that is, by the production of spores within the cell.

The use of yeast in bread making is familiar. When supplied with food (in the form of sugar), warmth, moisture, and air, yeasts grow, breaking up the sugar and producing alcohol and a gas called carbon dioxid. Bubbles of this gas are seen when canned fruits ferment. Since yeasts are abundant in the air and on the surface of fruits and vegetables, it is always necessary to destroy them on food being canned, to seal containers air-tight, and to prevent further entrance of these organisms into the canned foods. Yeasts usually are killed by moist heat at 190° F. (simmering).

Bacteria are much more difficult to destroy than molds and yeasts and are the chief foe to combat in all preserving of foods. They also are one-celled plants, smaller than yeasts, and usually reproduce by division. So rapid is this reproduction that a single bacterium may produce millions more in a few hours. Bacteria require for their growth warmth, moisture, and food. Certain species of bacteria

thrive without air. Since few bacteria thrive in acids or in the presence of much sugar, their destruction is less difficult in fruits and tomatoes than in such vegetables as corn, peas, and beans or in meats, which are the most difficult of all foods to can safely.

Bacteria in their active growing state can be killed by subjecting them to moist heat at boiling temperature for different lengths of time. Unfortunately for the canner, many kinds of bacteria have the power under adverse conditions of producing spores, which are much more resistant to heat than are the growing stages. These spores may be compared to the seeds of higher plants in their ability to withstand adverse conditions. It is known that some spores are able to resist boiling temperature for hours. All bacteria in the spore state can be destroyed by subjecting them to a temperature of 240° to 250° F., moist heat. This temperature can be secured only with steam under pressure. Almost all the bacteria which are so resistant to heat when in the spore state are abundant in cultivated soil, and therefore present upon the pods and husks of such vegetables as corn, peas, and beans, which contain the food upon which the spore-bearing forms thrive. The presence of these bacteria upon the parts of vegetables to be canned, therefore, is almost inevitable. The difficulty of sterilization is increasingly great when such vegetables have been bruised or allowed to stand, or have among them decayed portions.

Enzyms.—Fruits and vegetables, after being gathered, undergo natural changes which cause staleness and injure the quality. These changes take place with varying rapidity in different foods and are due to the action of substances known as enzyms, which have the power to cause ripening and other changes. The delicate flavors of many fruits are thus destroyed when they are allowed to stand too long before being canned.

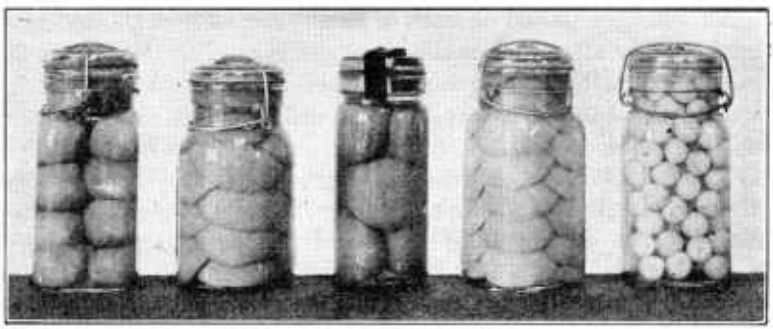

FIG. 1.—Peaches and cherries packed in glass.

PROCESSING.

The term sterilization, applied to canning, means the process of inclosing the food in cans or jars which afterwards can be sealed air-tight, and subjecting it to sufficient heat to kill all living organisms. To be effective, sterilization must be followed immediately by sealing the containers air-tight to prevent further entrance of germs. Cooking the food in the jar to sterilize it is called processing.

Formerly a common household practice in canning (applied chiefly to fruits and tomatoes) consisted in cooking the material to be canned in an open kettle, transferring it while boiling hot to hot jars which had previously been boiled, and at once sealing with a lid which also had been boiled. That this practice is uncertain is shown by the frequency with which a growth of mold appeared on the fruit canned in this way, causing loss. This method is objectionable not only because it so frequently results in spoilage, but also because it gives a product of inferior quality. Its use is also attended by discomfort and inconvenience to the housekeeper, who is forced to do most of the work indoors over a hot stove. With the exception of tomatoes, vegetables can not be canned by this method with the certainty that they will keep. For these reasons sterilization of fruits and vegetables after being packed in containers has largely superseded the practice of cooking in the open kettle.

Since certain vegetables are frequently attacked by spore-bearing bacteria, a longer period of processing at boiling temperature is required for them than for fruits. Sometimes processing 3 to 5 hours is recommended. The spores of some species of bacteria have been known to resist even five hours' boiling. Since this gives a chance for failure, the laboratory practice of intermittent or fractional sterilization is applied to household canning when a hot-water canner is used for processing certain vegetables. Intermittent sterilization consists of applying boiling temperature to vegetables already packed in containers for a period on each of three successive days, sealing the jar immediately after each boiling or "processing" if the lid has been loosened to allow for the expansion caused by heat. After each daily processing the containers are kept at ordinary temperature, under which the spores not killed by boiling develop into bacteria of the easily killed vegetative or growing stage, which are then destroyed by the next period of boiling. Rarely do any spores fail thus to develop and be destroyed by the third processing. Processing for 1 to 1½ hours in a water bath at boiling on the first day, repeated on the second and third days, will ordinarily sterilize beans, peas, and corn in quart jars, if these vegetables are selected properly and handled carefully. In very warm weather an interval of only 18 hours between first and second processings is advised. This is the safest procedure to follow with hot-water canners. When a steam-

pressure outfit is used, a higher temperature can be obtained and the period of sterilization shortened, at the same time eliminating the uncertainty of securing complete sterilization. Greater safety is thus secured with steam-pressure canners.

AIDS TO STERILIZATION.

The first essential for complete sterilization with the use of either the hot-water canner or the steam-pressure outfit is absolute cleanliness in surroundings and in all utensils used in canning. Tables should be well cleaned and may be covered with white oilcloth. Garbage cans must be provided to hold peelings and other refuse. To allow these to fall upon the ground to decay near the place of canning will result in production of spores which will rise in dust and infect the material being canned.

Greater safety will follow if containers and lids are cleansed by boiling for fifteen minutes after being washed thoroughly. They should then be inverted on a clean surface until used. Cleanse rubbers by dropping for a minute into a boiling solution of soda and water (1 quart of water to 1 teaspoonful soda), removing from fire at once to prevent injury to them.

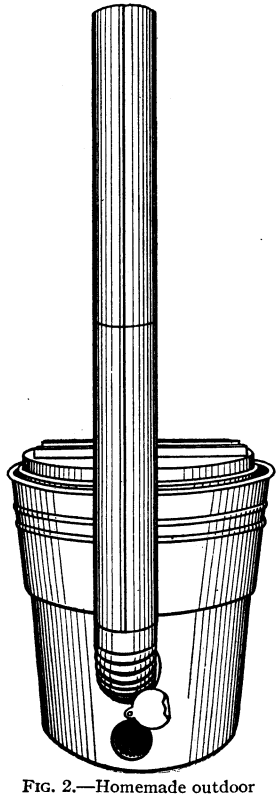

FIG. 2.—Homemade outdoor canner.

TESTING THE SEAL.

After fruits and vegetables are canned and set aside for 24 hours, lightning seal or hermetic jars may be tested by raising the clamp and attempting to lift the jar by the lid. If the lid comes off, the food may be fermenting. If the lid remains tight, the chances are that its contents are keeping. Screw-top jars may be tested by simply inverting to see if there is any leak. Test all jars, so that when faulty sealing alone exists, jars may be reprocessed and contents saved. If the food is fermenting it should be discarded. However, the tight seal is not always an indication that the food is keeping. Some foods are often attacked by bacteria, which thrive without the presence of air, and which decompose canned foods without producing any gas. When these bacteria have not been killed by processing, the food may appear good and the jar remain sealed yet the contents may be unfit for use. In tin these spoils are known as "flat sours" because the can is not bulged and shows no indication of spoiling. This kind

of failure is often due to canning stale vegetables. Fibers of stale vegetables become tough and heat will not penetrate them so easily. Therefore the period for processing should be lengthened.

Very often plants absorb from the soil or from fertilizers certain minerals that have a tendency to make the fibers of the plant more resistant to heat, thereby necessitating a longer period of processing in order to destroy all spores present.

EQUIPMENT FOR CANNING IN THE HOME.

When canning in small quantities, it is not necessary to purchase special equipment (fig. 2), although inexpensive portable equipment for use in or out of doors may be purchased (fig. 3). If considerable canning is done, such outfits will prove convenient and save labor. Especially is this true when a comfortable out-of-door place can be selected for the work.

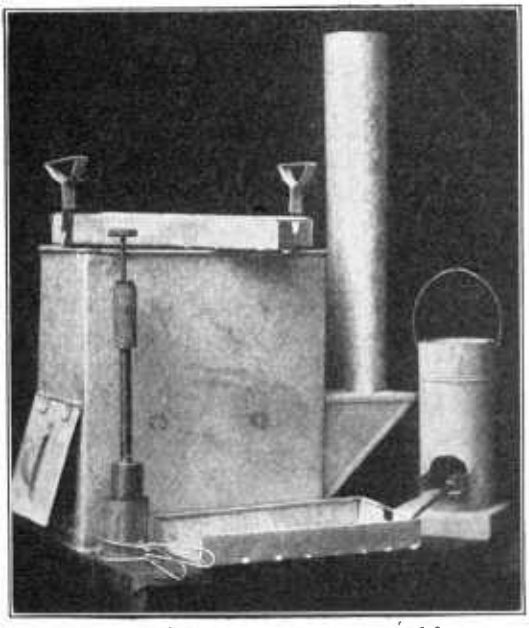

FIG. 3.—A small portable hot-water canner and fixtures.

The practice of packing fruits and vegetables into containers and sterilizing the product after it is packed has superseded to a very large extent the old plan of cooking the food in an open kettle, transferring it hot to the jar, and sealing without any further sterilization. Since this is true, the first consideration is a processing vessel. A wash boiler, bucket, or galvanized tub when fitted with a false bottom and a tight cover makes a convenient processing kettle or canner. It may be used on the kitchen stove or placed on a furnace out of doors. One important factor is to be able to bring the water in this canner quickly to the boiling point and maintain this temperature steadily. The false bottom is a rack which keeps the jars from coming in contact with the metal which is next to the flame. This prevents breakage. Racks made of strips of wood are probably the best. Sometimes wire netting, or perforated galvanized trays, are used. If the latter are used, they should be raised about 1 inch or 2 inches above the bottom of the vessel to allow circulation of water under the jars.

TYPES OF CANNERS.

Hot-water canner.—Several convenient types of portable canners are on the market. The simplest hot-water outfit is one to be placed on the kitchen stove. Another, more complete, has a fire box attached and is used out of doors. These outfits also include blanching trays, tongs for handling hot jars, a false bottom, and tools necessary for sealing tin cans. The canner which has been described (figs. 2 and 3) is commonly known as a water-bath canner.

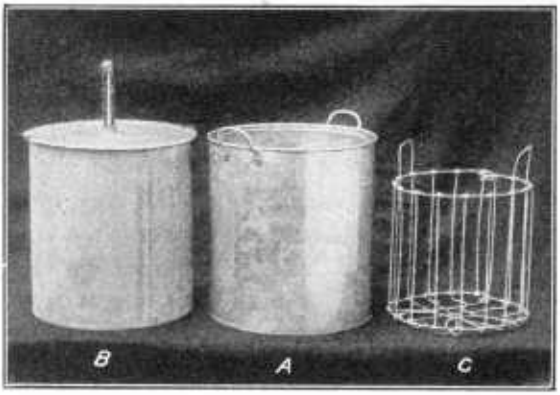

FIG. 4.—A type of water-seal canner: (*A*) Double-walled vat, (*B*) cover with thermometer, (*C*) crate for jars and cans.

The type of canner should be chosen with reference to the kind and amount of canning to be done. The small hot-water canner is the least expensive of the commercial outfits for home canning. For inexperienced people it is also more easily handled. This type of canner is preferable for processing fruits and tomatoes. They are canned safely at boiling temperature and the texture, flavor, and color of the finished products so processed at this temperature are superior to those which have been subjected to the higher temperatures.

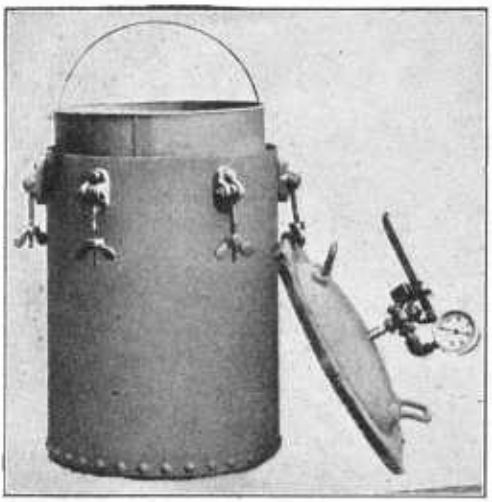

FIG. 5.—A type of cast-iron steam-pressure canner. Will carry 30 pounds of pressure.

Water-seal canner.—Another type of canner is known as the water seal (fig. 4). The advantages of this type of canner are that only a small quantity of water is needed and it can be raised quickly to the boiling point with the use of very little fuel. When the lid is in place a slight pressure is secured and a steady temperature 2° or 3° higher than the boiling

point can be maintained. In this bulletin no separate time-table for processing in the water-seal canner is given. No investigations have yet been made which prove that the slight difference in temperature obtained in the water-seal canner warrants any change of processing periods.

Steam-pressure canner.—The steam canner is constructed out of strong material and provided with a tightly fitting lid, which when clamped in place makes it possible to hold steam under pressure and obtain a correspondingly high temperature. It has a steam gauge and thermometer attached to the lid (fig. 5). These attachments register the temperature and the corresponding number of pounds pressure. Since the steam canner is made of very heavy material, a greater degree of heat is required to bring up the temperature quickly.

When large quantities of vegetables such as beans, peas, corn, etc., are to be canned, much time, labor, and fuel can be saved if the steam-pressure outfit is used. When a temperature of 250° F. is maintained for a sufficient length of time, all spores can be killed in a single period of processing.

CONVENIENT UTENSILS.

Whether a homemade or commercial canner is used, it is necessary to assemble certain utensils which are found ordinarily in every home (fig. 6). For grading, sorting, and washing, shallow trays, pans, or bowls, and vegetable brushes are needed. In washing berries a colander or sieve should be used. For blanching, squares of cheesecloth or a wire basket, together with a large vessel for holding the boiling water, should be provided. This vessel should be deep

FIG. 6.—A simple home canner.

enough to submerge a convenient quantity of the products to be blanched. Slender-pointed knives are convenient for peeling, paring, and cutting. It is much better to use a silver knife for peeling fruits, as the fruit sometimes is discolored by steel. When canning in large quantities, slicers, corers, pitters, and food choppers

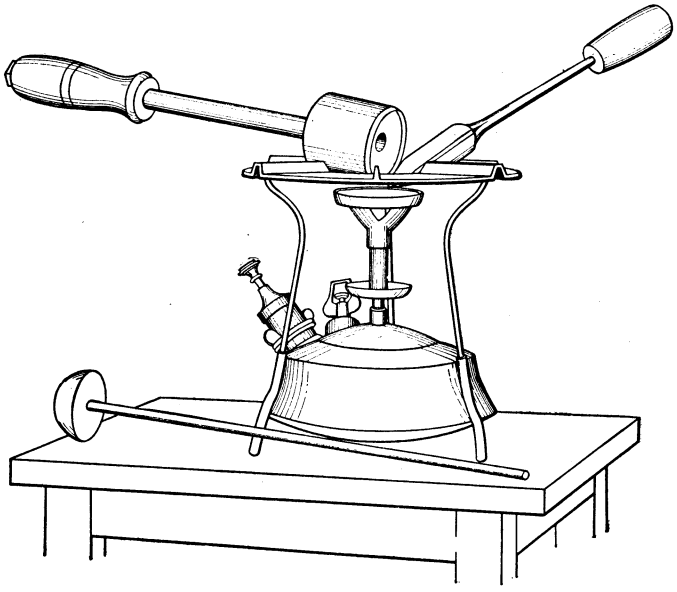

FIG. 7.—Kerosene gas stove.

will make it possible for one to work more rapidly. A half-pint measuring cup, teaspoon, tablespoon, spatula, scales, salt per cent scale, and saccharometer will aid in securing accurate results. If the product to be packed is to be cooked, wooden spoons, sieves, and saucepans are necessary. Packing paddles and sirup paddles will aid in filling the jars. If the canning is to be done out of doors, tables of convenient height, a covered garbage pail, and a flytrap are needed. The most convenient portable canners contain both processing and blanching compartments. A kerosene stove which burns a gas flame gives intense heat and is convenient for use in jelly making, preserving, and concentrating ketchups and sauces (fig. 7).

CONTAINERS.

For home use, glass jars are more economical than tin, because they can be used many times and with care will last for years. New rubbers must be used each year, and it pays to get the best quality of rubbers.

The best type of jar for home use is one with the so-called lightning seal, having a glass lid held in place by a wire clamp. This lid

is not only more sanitary, but with care can be used as long as the jar lasts. For intermittent processing the lightning-seal jars are suitable, because the lifting of the wire clamp each day during processing insures that the jar will not be broken by expansion and the rubber not worn by the unscrewing of the cap.

Another type is the hermetic seal, with a lacquered metal top. The top has around the inner edge a narrow gasket of composition which, when heated, softens and adheres to the glass. The top is held in place during the processing by a wire clamp. It is self-sealing as it cools and is not suitable for intermittent processing.

If the old-fashioned screw-top jar is used, good caps are essential for safety. After having been used the edge of this cap becomes flared and the porcelain lining frequently is loosened from the top. This lid then not only is difficult to sterilize but may fail to give an air-tight seal. If such jars are on hand and must be used, it will be better to use them for the canning of fruits, preserves, and other products which are easily processed and to secure jars of the lightning-seal type for vegetables which are more difficult to preserve.

ARRANGEMENT OF EQUIPMENT.

Discomfort and fatigue can be lessened greatly by careful planning of the arrangement of equipment used in canning. When working indoors it is often possible to carry on much of the preparation of fruits and vegetables on the porch, thus minimizing the work of clearing away refuse afterwards. Canning is a much more attractive work when it is done in a cool, shady, outdoor place free from dust. This is especially true when several members of the family or a group of club members are working together. It is well to have two tables so that different stages of the work may be kept distinct. On the first table, for instance, may be placed vessels for sorting and grading, a supply of fresh cold water for washing the fruit, and a blanching basket or squares of cheese-cloth. On the second table place paring knives, spoons, measuring cups, scales, wooden paddles, sirup, brine, or seasoning, fresh clean cloths, and bowls or pans. Use this table for peeling and packing and place the garbage can near it. When jars have been boiled for 15 minutes they may be brought in trays to this table, inverted on a clean surface, and covered until needed. The canner should be placed so as to be convenient to both tables and should be provided with stovepipe high enough to convey the smoke above the heads of the workers.

Management of steam-pressure canner.—In the bottom of the steam-pressure canner (retort) pour boiling water to a depth of from 1 to 1½ inches. Place canner over the fire so that the water can boil vigorously. Put cans in the crate, and lower this into retort. Put on the cover and screw down clamps so cover is on steam

tight. Turn petcock so steam can not escape and adjust safety valve to the number of pounds steam pressure desired. Raise temperature by quick fire until the gauge on cover of retort shows the desired steam pressure. Then open safety valve or petcock a little in order to let dead steam escape. Partly close again so only a very small amount of steam can escape, but do not close entirely. Count time from the moment steam pressure in canner reaches the pressure desired. Keep a steady fire going in order to maintain a uniform temperature until time is up. Then open petcock or safety valve to let all steam escape before unfastening the clamps or screws holding lid down. When the gauge shows that all steam has escaped, unfasten the clamps, take off the cover, and lift the crate out. When canning in glass it is important to cool the retort without opening the petcock before removing the containers in order to prevent loss of liquid from them. As soon as the jars are taken from the canner the lids should be tightened and a cloth spread over the jars, to protect from drafts of air, until cold. If cans are used, test for leaks by immersing in cold water. If any are found, cans must be resoldered and again processed in canner.

CANNING IN GLASS.

Select jars which are appropriate for the fruit or vegetable to be packed, considering the size of the container from the standpoint of the quantity desired when opened, the size of the fruit or pieces of fruit to be packed, and the ease of sterilization.

Cleansing jars.—Wash these jars and place them, side down, in a vessel and cover with cold water. Bring this water slowly to the boiling point and allow to boil for 15 minutes.

Sorting and grading.—While the jars are being boiled sort and grade the fruit or vegetables according to size and degree of maturity. Discard all fruit that is overripe, underripe, or unsound. Vegetables which are in choice condition for the table—that is, young, tender, and fresh—are suitable also for canning. Those which have become stale are more difficult to process and the loss of flavor and deterioration in texture resulting from staleness make them unsuitable for canning.

Following the sorting and grading thorough washing is necessary before proceeding to paring, coring, or slicing. Some fruits and vegetables require scalding in order to remove peeling.

Blanching.—Blanching consists of plunging the vegetable or fruit into boiling water for a short time. Use a wire basket or cheesecloth square for this. The blanch gives a more thorough cleansing, improves the texture, and insures a clearer liquor. It also shrinks the fruit or vegetable and makes it more flexible. A full pack is then

made more easily. The time required for blanching varies with the state of maturity. (See time-table, p. 27.) After blanching the fruit or vegetable is placed for an instant into cold water to make more crisp and to aid further in shrinking.

Packing.—After selecting fruit or vegetable for uniformity in size and quality it should be arranged with reference to symmetry and the best use of the space within the jar. In placing the fruit or vegetable in a jar a thin, slender, flexible paddle, made out of cane or other suitable wood, is useful (fig. 8).

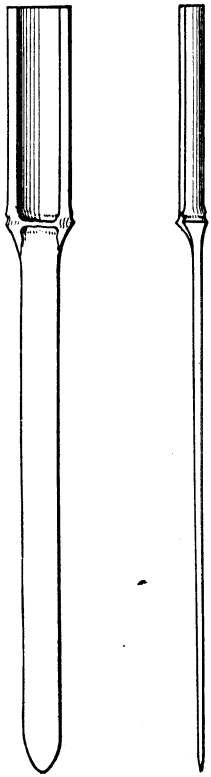

FIG. 8.—Paddle for use in packing.

When the jar has been packed as full as possible without crushing the pieces the sirup, brine, or seasoning is added. The slender paddle is used to take out bubbles of air after the liquor has been added to the pack.

Adjusting the rubber and cap.—Immediately before using, cleanse the rubber by dropping, for a minute, into a soda bath (1 tsp. soda to 1 qt. boiling water). Flatten the rubber in its groove, without the presence of any seed or particle of the fruit, before placing the cap. When a screw-top jar is used, screw the cap evenly about halfway. When a glass-top jar with wire clamp is used, place the lid on evenly and raise both clamps up, the upper one fastened to hold the lid in place. With a hermetic jar, fasten the cap on the jar evenly with the clamp. This type of jar is self-sealing as it cools.

Processing.—Place the jars in a water bath on a rack (a wooden rack is good) to avoid breaking. Have the water the same temperature as the contents, letting it come to within 2 inches of the tops of the jars. Have a tight cover for the vessel to keep the steam around the tops of the jars which are above water. Do not count time until the water begins to boil; keep it boiling steadily for the time required. Seal the jars air-tight promptly at end of processing and remove them from the bath, being careful not to allow a cold draft to strike them. In intermittent processing, raise the clamps of the jars at the beginning of each processing to allow for expansion. Seal at close of each processing. The hermetic jar can not be used for intermittent processing.

Storing.—Before storing allow jars to stand for 12 hours or more. Then examine the seal. With a lightning seal or hermetic closure take off the clamp and test the lid to see if it is tight. With a screw-

top jar, simply invert the jar to see if there is any leak. Store all products in a cool, dry, dark place.

Sirups.—In canning fruits the use of the sirups indicated in the table will give excellent results. These sirups have been selected with reference to securing good color, texture, and flavor in the finished product. For instance, sour fruits, such as cherries and plums, require a heavier sirup than sweet cherries, peaches, or berries. These sirups range in density from 10° to 50° as measured by a Balling saccharometer. The table is prepared to enable one to secure uniform results without the use of a saccharometer. No. 1 sirup is of 10° density, No. 2 of 20° density, and so on.

To make these sirups boil sugar and water together in the proportion given below until sugar is dissolved. Strain all impurities out of the sirup before using:

Sirup No. 1, use 14 oz. sugar to 1 gal. water.
Sirup No. 2, use 1 lb. 14 oz. sugar to 1 gal. water.
Sirup No. 3, use 3 lb. 9 oz. sugar to 1 gal. water.
Sirup No. 4, use 5 lb. 8 oz. sugar to 1 gal. water.
Sirup No. 5, use 6 lb. 13 oz. sugar to 1 gal. water.

Measurements.—If no scales are available, the amounts of sugar may be approximated by measuring, using 1 pint for each pound and 16 tablespoons to the half pint. For the recipes given in this bulletin all measurements are level and the standard measuring cup holding ½ pint is used. Abbreviations used are c., cup; tbsp., tablespoon; tsp., teaspoon; oz., ounce; and lb., pound.

FRUITS.

Processing fruits at boiling temperature gives better results in texture, color, and flavor than higher temperatures. The time for processing, given in each recipe which follows, is intended for water-bath outfits with temperatures at boiling, and should not be counted until boiling begins.

Apples.—Apples shrink more in canning than most fruits and for this reason should be blanched for 1 minute. Plunge them into a cold bath, then pack. Cover with No. 1 sirup, and process quart jars 12 minutes.

This method of canning apples is not economical because the apple is juicy and needs no water added. A better method perhaps is to make a sauce out of the apples. This may be done by steaming them until tender and passing them through a sieve. Allow 1 c. sugar to each gallon of pulp. Reheat until the sugar is dissolved, pack hot, and process quart jars 12 minutes.

Berries.—For dewberries, blackberries, loganberries, huckleberries, raspberries, and currants practically the same methods of canning may be used. The condition of the fruit will have much to do with the quality of the product. Berries should be gathered in shallow

trays or baskets and not in deep vessels which allow them to be bruised and crushed. They should be uniformly ripe, sound, and as large as possible.

The flavor of canned berries will be finer if sugar is used in canning. It is best to make this into a sirup. The use of berry juice instead of water in this sirup will give a richer color and flavor. For fine berries, use a No. 3 sirup, substituting berry juice for water.

After the berries have been sorted carefully and washed lightly by placing in a colander and pouring water over them, instead of immersing them in water, pack as closely as possible without crushing. This can be done better by putting a few berries into the jar, pressing them gently into place, and proceeding layer by layer, than by nearly filling the jar loosely and then trying to press them down.

Fill jars full of fruit and cover with sirup. Process pints 10 minutes and quarts 12 minutes.

Cherries.—When canned whole, cherries should be blanched for 15 seconds to prevent splitting. For sour cherries use No. 4 sirup; and for sweet ones No. 3. Process quarts 25 minutes.

Figs.—Figs for canning should be sound and firm. Sprinkle 1 c. of soda over 6 quarts of figs and add 1 gallon of boiling water. Allow the figs to stand in the soda bath for 5 minutes. Drain and rinse thoroughly. Bring 2 quarts of the No. 3 sirup to boiling and add the well-drained figs. Allow the fruit to boil in this sirup for 1 hour. Place the fruit carefully in the jars and then fill to overflowing with the sirup. Process quart jars for 30 minutes.

Gooseberries.—Since green gooseberries contain sufficient acid to preserve them without processing, they may be packed, like rhubarb, in cold water or as a sauce.

Make the sauce by cooking together the sugar and fruit in the proportion of ½ c. of sugar for each quart of gooseberry pulp. When the sugar is dissolved, pack the sauce hot and process for 10 minutes. Ripe gooseberries are packed in a No. 3 sirup and processed as other berries.

Guavas.—Only firm, sound guavas should be used for canning. Pare the fruit, cut into halves, and remove the seeds. Float the halves in boiling water for 20 seconds. Drain and pack carefully as for peaches. Fill the jars to overflowing with hot No. 4 sirup and process quarts for 25 minutes.

Peaches.—Before preparing fruit make sirup No. 3 or 4 (see sirup table), allowing about 1 c. water for each quart jar. Put in one cracked peach pit for every quart of sirup. Boil for 5 minutes and strain.

Sort the fruit, using firm, sound, uniform peaches for canning and putting aside the soft broken ones for jam. Peeling may be done by immersing in boiling water about 1 minute or until skins slip easily.

Remove, plunge for a minute into cold water, and slip off the skins. Cut into halves and pack at once (fig. 9), placing the halves in overlapping layers, the concave surface of each half being downward and the blossom end facing the glass. Fill each jar with sirup and paddle carefully to remove air bubbles. Process quarts 20 minutes and half gallons 35 minutes.

Firm, perfect peaches may be floated in boiling water for about 20 seconds after being peeled. They are then cut in halves, seeds removed, and packed as indicated above. By floating the peaches in this manner, they are made more flexible and pack to better advantage; they also become mellow, absorb more sirup, and are finer in flavor. (See fig. 1.)

Pears.—Select ripe pears which are not too soft. Peel, blanch by lowering for 15 seconds in boiling water, put in cold bath, drain, and pack rapidly. This blanch will make the hard varieties of pears pack better and give them a more transparent appearance. When packed whole, leave stems on and place each layer stems up, letting the second row fill the spaces between the two stems, and repeat.

When the jars have been packed with fruit, fill with No. 3 sirup and process quarts for 25 minutes.

Plums.—Select sound, uniform fruit. Prick with needle to prevent bursting. Pack as firmly into the jars as possible without crushing and fill with a No. 4 sirup. Process quarts for 15 minutes.

Rhubarb.—Because of its extreme acidity, rhubarb can be canned safely without processing. Select young, tender rhubarb and cut either into 2-inch pieces or into lengths to fit the jar when placed vertically. Pack in sterilized jars in vertical rows. Cover with fresh cold water and allow jars to stand 10 minutes. Drain off the water and again fill to overflowing with fresh cold water. Use cleansed rubber, cap and seal at once. In the far South rhubarb should be processed in a hot-water bath, pints 10 minutes, quarts 20 minutes, at boiling.

FIG. 9.—Economizing space in packing.

Since rhubarb contains much water, a better and more economical product could be secured by canning rhubarb sauce. Cut the rhubarb into 1-inch lengths and steam until tender. For each quart of sauce add ½ c. of sugar. Pack hot and process quarts for 10 minutes.

Fruit juices.—The juices of such fruits as grapes, currants, blackberries, strawberries, raspberries, elderberries, and cherries make a delicious and wholesome drink, and should be much more widely used in the home. The flavor of these juices is finer when they are processed below the boiling point. Select sound ripe fruit, crush, and heat slowly to about 180° F., simmering point. Strain through double thickness of cheese-cloth and, if juices free from sediment are wanted, let stand in a cool place for a few hours. Then pour off carefully to free from the dregs, which will remain in bottom of vessel. The addition of sugar will make flavor finer. It may be used in any desired proportion, a fair allowance being 1 c. of sugar to 1 gallon of juice. It is more economical to sweeten some fruit juice with the natural sirup obtained from the same fruit—for example, apple and grape. Pour the juice into hot bottles, put sterilized stoppers in lightly, set bottles on rack in water bath, and process at simmering point for 30 minutes. Remove from water bath, put cleansed stoppers in tightly, and when cool dip top of bottle into melted paraffin or sealing wax. A good wax may be made by melting together equal parts of rosin and beeswax.

These homemade fruit juices will be excellent for use in gelatin desserts, puddings, sauces, ice cream, sherbet, etc. They can be bottled without any sugar and later made into jelly. This method for grape jelly insures the getting rid of potassium acid tartrate crystals, which are objectionable in the jelly.

VEGETABLES.

Either the water bath or the steam-pressure canner may be used in processing vegetables. For certain vegetables that are difficult to sterilize, there is an advantage in the saving of time, labor, and fuel by the use of a steam-pressure canner. The temperatures in the following recipes are given in Fahrenheit readings, because this thermometer ordinarily is furnished with steam-pressure outfits. The time given for processing under steam is for one continuous period. In canning vegetables that have become somewhat stale, the period of processing should be lengthened. (See time-table, p. 27.)

Brining and seasoning.—Brine or water is added, immediately after packing, to such vegetables as need to be surrounded by liquid either for proper preparation or for sterilization. No more liquid is

allowed than is actually necessary to cover the contents after as full a pack as possible is made. For seasoning tomatoes, peas, lima beans, and corn, a mixture of sugar and salt is added. This seasoning improves the flavor of these vegetables greatly. Mix the sugar and salt in the proportion of one-third salt and two-thirds sugar. Add the seasoning at the rate of 1 level tsp. for each pint of vegetables. Brine for beans, okra, etc., should contain 2½ oz. salt to 1 gallon of water. For asparagus a heavier brine is needed.

Asparagus.—It is of the greatest importance that asparagus for canning be fresh and tender. Select tips of uniform size and maturity and wash them. Cut in right length for cans, scrape off tough outer skin, and tie in bundles. Blanch by immersing the lower ends part way in boiling water for 2 minutes. Then immerse the entire tips for 1 to 2 minutes longer. Plunge into cold water, then pack neatly, tips up. Fill jars with brine (4 oz. salt to 1 gallon water) and process pints in a hot-water bath 1 hour on each of three successive days or in a steam-pressure canner 30 minutes under 10 lbs. steam, at a temperature of 240° F. In the far South it may be necessary to raise the temperature to 250° F. for the same period.

String beans.—The Refugee is a good variety for canning. The beans should be tender and fresh. When the beans within the pod have grown to any size, canning is more difficult and the product of poorer quality from a commercial standpoint. For canning, only well-sorted, small, tender beans should be used. String the beans and cut them into 2-inch lengths; cutting diagonally or "on the bias" gives a pretty product. In glass they may be canned whole, packed log-cabin fashion in square jars (fig. 10). Blanch 3 to 8 minutes or until the pod will bend without breaking, and plunge into cold water for an instant. Drain well, pack quickly, and cover with brine. When the beans are young and tender, process pints 2 hours continuously at boiling temperature, or, if more mature beans are packed, process intermittently. Process quarts intermittently, or 45 minutes under 10 lbs. steam, at a temperature of 240°.

Lima beans are treated as peas, adding sugar and salt seasoning instead of brine. This seasoning is added when the jar is half packed with beans. When the jar is filled with beans, cover them with clear water, paddle to remove air bubbles, and process as for peas.

Baby beets.—The best variety of beet for canning is the Detroit. From the standpoint of quality, only young, tender beets should be canned. Sort, putting uniform size together. In preparing beets for boiling, be careful not to cut the stems off too closely or to break the root. This will cause loss of juice with accompanying loss of color and flavor. Boil until three-fourths done, peel, pack in layers

of three or four, fitting the second layer into the spaces left by the first layer, and repeat. Cover with clear hot water. Process quart jars 1 hour at 212° F. or 30 minutes under 5 lbs. steam. Do not allow cold water to touch the beets after they have been cooked.

Carrots.—Proceed the same as for beets.

Corn.—Much depends upon careful selection of tender, juicy corn before it reaches a starchy stage. It should never stand longer than a few minutes after being taken from the stalk. Corn which has passed the milky stage or is stale is very difficult to sterilize. Blanch on the cob 1 to 3 minutes. Cut; pack into jars to within 1-inch of the top. Add salt and sugar seasoning and cover with clear water. Paddle to allow liquor to penetrate to the bottom of the jar. Process pints at 212° F. intermittently for 1½ hours on the first day and 1 hour on the two succeeding days, raising the clamp during each processing. Corn expands in cooking and jars may be broken unless clamps are loosened during processing. With steam under pressure, process corn 1 hour and 20 minutes under 15 lbs. pressure at a temperature of 250° F. Take every precaution to have good rubbers.

Okra.—Select young, tender pods, remove stem without cutting into seed pod. Blanch 6 to 8 minutes. Plunge into cold salt bath as for peas. Pack, cover with brine, and process intermittently, or for 30 minutes under 10 lbs. steam pressure.

Peas.—Peas are more difficult to can than most other vegetables, and great care should be taken to have them very fresh and young. They are best gathered in the early morning or when cool. Work should be done rapidly, and peas should not stand after being shelled. Shell and sort, putting peas of the same size and degree of maturity together. Be sure not to use hard ripe peas among tender ones.

Blanching is very important. If well done it prevents cloudy liquor, makes the peas tender, and also removes some of the gluey substance which coats them. Blanch 1 to 4 minutes, depending upon the maturity of the peas. Put again into cold salt water (1 tbsp. salt to 1 qt. water) for an instant after blanching.

Drain and pack to within ½ inch of the top of the jar. If too full, some of the peas will burst and make the liquor cloudy. Add sugar and salt seasoning, fill with water, and paddle well.

Process medium-sized peas packed in pints intermittently at boiling, or 45 minutes under 10 lbs. steam pressure.

Peppers.—The best sweet peppers for canning are the Spanish varieties known as pimentoes. The fruit of these peppers has very thick flesh, tough skin, and is comparatively smooth and free from ridges. The bell peppers are not suitable varieties for canning. Peppers should be ripe, sound, and free from bruises. Sort, using the

whole peppers for canning and small or broken peppers for products such as sauces, soups, chutneys, and Dixie relish. Prepare for peeling by placing peppers in a hot oven for 6 to 8 minutes, being careful not to allow them to become hot enough to discolor. Peel, cut out stem, remove seeds, and pack dry in flattened layers. No water or seasoning is used in the preparation of these peppers; the processing brings out a thick liquor which almost covers them in the can. Process pints for 30 minutes.

Sweet potatoes.—The canning of sweet potatoes with uniformly successful results is difficult. It is very much better to use correct methods of storing than to can them.

A sweet potato which is dry and mealy when canned is desirable. The Nancy Hall is one of the best varieties for canning. Triumph and Southern Queen also are used.

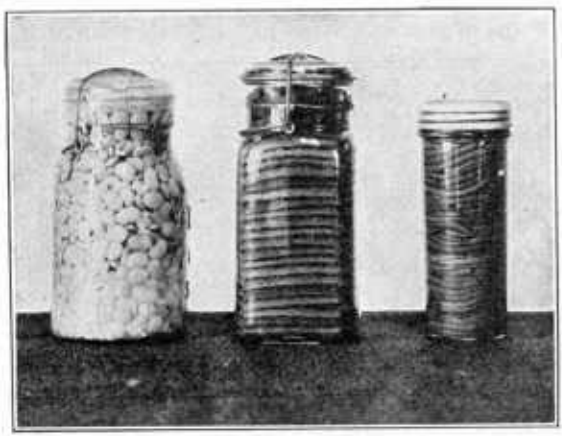

FIG. 10.—String beans and lima beans.

Processing sweet potatoes intermittently tends to darken the product; therefore processing under steam pressure is advised for home use. Select absolutely sound potatoes and grade, putting together those of the same size. Boil or steam until three-fourths done. Peel and pack hot at once to prevent discoloring. Process 3 to 5 hours continuously at boiling, or 70 minutes at 250° F.

Concentrated vegetable soup.—Any desired mixture of vegetables may be packed for home use. A good combination consists of 1 quart concentrated tomato pulp, 1 pint young, tender corn or tiny lima beans, 1 pint okra, 4 tsp. salt and sugar seasoning, 1 small onion chopped, and ½ c. of chopped sweet red pepper. Cook the tomatoes, pepper, and onion, put through a sieve to remove seeds, and cook down to about the consistency of ketchup. Measure, add the corn or beans and okra, which have been prepared as for canning, add seasoning, and cook all together for 10 minutes. Pack and process pints for 2 hours continuously at boiling, or for 30 minutes under 10 lbs. steam pressure. Process quarts intermittently. (See p. 33 for tomato paste.)

Spinach.—Prepare the spinach by cutting off all dead leaves and roots. Cover each peck of spinach thus prepared with scalding soda

solution (1 tsp. soda to 1 gallon water) and allow to stand for 2 minutes. Wash thoroughly through several cold waters, and drain well. Blanch in rapidly boiling water for 4 minutes. Drain well, pack into jars, cover with boiling brine, and process pint jars 1 to 2 hours at boiling, or 30 minutes under 5 lbs. steam pressure.

If it is desirable to can other greens, these directions may be followed.

Tomato.—Select firm, uniformly red, ripe tomatoes of medium size. Put into trays and lower into boiling water for 1 minute. Remove and cut out the core with a slender-pointed knife without cutting into the seed cells. Peel promptly and pack into jars. Add sugar and salt seasoning and fill the jars with a hot thick tomato sauce. This procedure is economical, because each quart jar will give whole tomatoes for salads or baking and a tomato purée for soups or sauces. This purée or sauce, which is poured over the whole tomatoes, is made by cooking the small or broken tomatoes until tender. The seeds are then removed and the pulp is concentrated by boiling to about the consistency of ketchup. Process quarts 25 minutes at boiling.

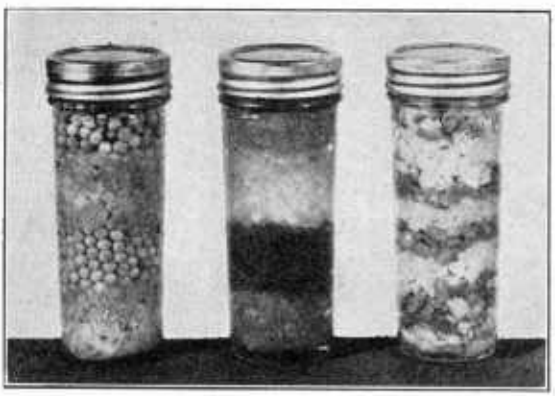

FIG. 11.—Vegetable mixtures.

Tomato sauce or purée.—If a more economical utilization of space within the jar is desired, a more concentrated mixture can be packed. This also provides for the use of small or broken tomatoes and large tomatoes unsuited for canning.

Cut the tomatoes and add 1 large-sized onion chopped and 1 c. chopped sweet red pepper to each gallon of tomatoes. Cook until tender, put through a sieve, and add sugar and salt seasoning in the proportion of 1 tsp. to each quart of pulp. Cook to the consistency of ketchup, stirring constantly. Pack hot into jars or bottles and process pint jars 25 minutes at boiling.

Vegetable mixtures.—Attractive and economical vegetable mixtures to be served in salads, with omelets, escalloped dishes, and garnishes for meat dishes can be packed. This can be done often when small quantities are left from packing different vegetables whole. Any desired combinations may be made. Vegetables maturing in the same season should be used. A good combination for

the spring would be carrots, peas, string beans, and onions. A mixture which could be made from the fall garden might consist of peppers, celery, onions, and small lima beans. All these vegetables are prepared separately as for canning and packed in layers in the jar (fig. 11). Each layer should be packed as tightly as possible before the next is added. When the jar is filled, cover with brine and process intermittently. Beets can not be used in this mixture because they discolor the entire contents of the jar.

The time-tables given for processing are safe only when young vegetables are secured. Mature or tough vegetables require a longer period or higher temperature.

CANNING IN TIN.

Before undertaking canning in tin, special equipment, including capping steel, tipping copper, fire pot for heating tools, cans with solder-hemmed caps, flux, sal ammoniac, and wire solder, must be secured. Follow all instructions for canning in glass up to the point where packing is done. See time-table for blanching period and for processing period for containers of different sizes. Note also the vegetables and fruits which require enamel-lined or inside-lacquered cans.

Number of cans per bushel yielded by the following vegetables.

1 bushel of tomatoes yields 24 No. 2 cans.
1 bushel of tomatoes yields 18 No. 3 cans.
1 bushel of beans yields 20 No. 2 cans.
1 bushel of beans yields 14 No. 3 cans.
1 bushel of peas in hull yields 25 No. 2 cans.
100 ears of corn yields 30 No. 2 cans.

Flux is used in cleaning and retinning tools and is also used in sealing the cans. It is brushed around the cap before the hot tool is applied and causes the solder to adhere to the tin.

Making flux.—Put some commercial hydrochloric (muriatic) acid into a glass or crockery vessel (not metal), add strips of sheet zinc until no more can be dissolved. To this add an equal quantity of water. Label this "Flux" and use carefully. When canning, have one vessel (a can will do) with enough flux in it to clean the tools. Keep separately in a glass bottle the quantity to be used in sealing cans.

Cleaning and tinning the steel and copper.—It is of first importance to have the capping steel and tipping copper in good condition. These may need to be rubbed with coarse sandpaper or on a soft brick to smooth them, or the steel may have to be filed to remove the rust. In the latter case care must be taken to keep the edge of the steel true. Both the capping steel and tipping copper must be kept

tinned or coated with solder to make the solder flow evenly when sealing. Have ready in a can a handful of sal ammoniac mixed with a few pieces of solder. Heat the already smoothed capping steel or tipping copper until almost red hot, dip into the flux, then into the sal ammoniac and solder, turning it about and rubbing until bright and well coated with solder. Then dip into the flux again.

Packing.—(See table, p. 27, for size of cans to use for different vegetables.) The Federal laws require cans packed for sale to be filled as full of food as is practicable for processing and to contain only enough liquor to fill the spaces and cover the contents. Weigh a sufficient number of cans before and after filling to obtain an accurate idea of average net weight. On account of expansion in processing, corn can be packed less full than other vegetables. These instructions do not cover the canning of corn for market. Mark the cans with a pencil or knife to show contents. Plan in advance and work rapidly. Let one person do the packing and another attend to the weighing. Do not allow filled cans to stand before adding liquor and exhausting. To do so will injure the product.

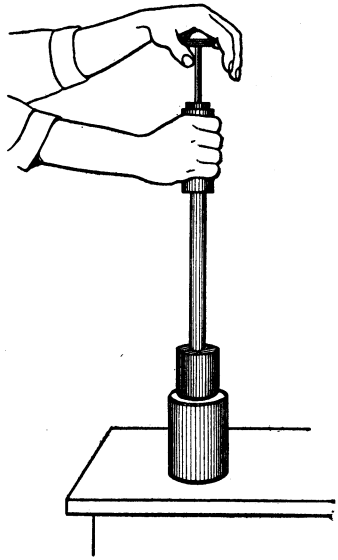

FIG. 12.—Capping a can.

Adding brine, sirup, or water.—After adding to within ¼ inch of top, shake the can gently to displace all air within it. Now clean and wipe the groove around the opening. Slip on the cap and weigh before sealing to be sure of having the required weight.

Fluxing and capping.—Apply the flux carefully around the groove, making sure that none of it enters the can. Use a small brush or cord, or little mop made by tying a piece of clean white cloth around the end of a small stick. The flux is used to make the solder adhere to the tin. Apply the clean, hot capping steel, holding the cap in place with the center rod while you lower the steel, and turn it steadily until the solder flows (fig. 12). Hold the rod firmly and lift the steel with a sudden twist to swing the melted solder around the groove evenly.

A good fire pot can be made out of a galvanized bucket as shown in the illustration (fig. 13). Charcoal or corn cobs can be used as fuel.

Exhausting.—Place the cans in trays and lower into boiling water to within 1 inch of the top to drive the air out of the cans. Let them stay the shortest possible time necessary to drive out the air. Ordinarily 3 minutes is enough, and the temperature need not again

reach boiling before cans are taken out. Exhausting is necessary. If omitted, the air left in the can expands, causing it to bulge. The can may not resume normal shape again, or if it does and is exposed to a warmer temperature it may again expand, giving the appearance of a "swell." This will not only prevent sale of that can, but may also cut off future orders. Furthermore, the presence of air may cause the tin to dissolve more readily and enter into the food.

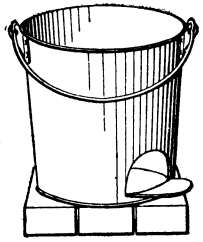

FIG. 13.—A homemade fire pot.

Tipping.—Close the small hole in top of the can immediately after exhausting. Apply flux as for capping, and use a little wire solder to close the hole. Hold the solder with the left hand near the hole and barely touch the hot copper to it, so that only a bead will drop and cover the hole (fig. 14). This makes a neat tip.

Processing.—Boil the cans which have been exhausted and tipped to sterilize the contents. Have the water boiling vigorously when the cans go in. Lower cans slowly under the water and look out for any showers of bubbles from a can. These show that it leaks at the point from which the bubbles come and must be taken out and resoldered. Begin counting time when the water first boils after immersing the cans. Keep it boiling constantly. In intermittent processing the vegetable is processed for 1½ hours on each of 3 successive days. The time sometimes is reduced to 2 days with very young string beans and some other more easily sterilized vegetables. It is not possible to state the shortest time which may be used safely because of the varying conditions.

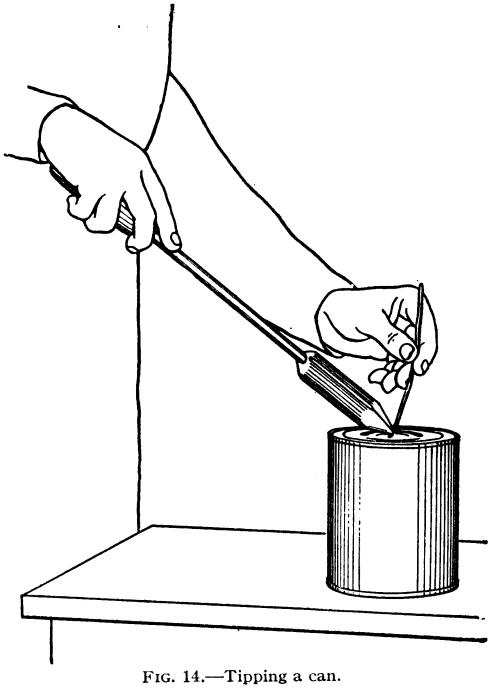

FIG. 14.—Tipping a can.

Cooling.—Cool all canned products as quickly as possible to stop the cooking, which breaks down the fruit and injures the flavor and color. Plunge the cans into very cold water immediately, especially when processing intermittently. Never stack cans close together until entirely cold.

Labeling.—After 8 to 10 days, or immediately before selling, label all cans. Place the sealed end down, so that the opposite end will appear at the top when placed on the shelf. Use a rather dry paste, and put it only on the end of the label, so that no paste will touch the tin. If paste touches the can, it may cause rust. Where a damp climate causes cans to rust easily, the outside of the can may be lacquered before being labeled. Net weight in pounds and ounces and packer's name and address should appear on each label.

STANDARDS FOR 4-H BRAND CANNED VEGETABLES.

Tomatoes.—Cans to contain not less than 2 pounds 1 ounce tomatoes in No. 3 and not less than 1 pound 4 ounces tomatoes in No. 2 cans. To be filled with sound ripe fruit, carefully peeled and cored; tomatoes to be whole or in large pieces, firm, uniformly red, and of good flavor. No juice in excess of the amount present in the tomatoes canned is allowed. Any water is considered an adulteration.

Tomatoes and green pepper.—Cans to contain not less than 2 pounds packed in No. 3 cans. For this pack add 1 medium-size green sweet pepper, after removing the stem and seeds, to each can of tomatoes.

String beans.—Net weight, in No. 3 can, before liquor is added, should be at least 1 pound 8 ounces, brine 8 to 10 ounces. Net weight in No. 2 can should be 13 ounces beans and about 8 ounces liquor. Beans to be tender, green, uniform in size, well strung, and of good flavor. The net weight appearing on label for No. 3 can should be 2 pounds, and for No. 2 can 1 pound 5 ounces.

Peas.—No. 2 cans to have at least 13½ ounces net weight of peas and about 8½ ounces liquor; peas to be fairly uniform in size, tender, whole, and of good flavor; liquor clear. Net weight appearing on label should be, for No. 2 cans, 1 pound 8 ounces.

Baby beets.—To be packed in No. 2 lacquered tins, about 30 baby beets to each can, maximum size 1½ inches in diameter and average size 1 inch in diameter. No. 2 can to have at least 16 ounces whole beets and 4 ounces liquid. Net weight appearing on label should be, for No. 2 cans, 1 pound 4 ounces.

Okra.—Net weight of contents in No. 3 can should appear on label, 2 pounds. Only young, tender okra should be packed, and it is best simply to remove the cap without cutting into the seed pod and to pack it whole. Brine is added as explained in the table.

Peppers.—No. 2 cans to contain from 8 to 10 whole peppers. Flat No. 1 cans to contain 4 or 5 whole peppers. Net weight of contents appearing on the label should be for No. 2 can not less than 1 pound, or flat No. 1 can not less than 8 ounces.

Soup mixture.—This should consist of a mixture which is made in the proportion of one-half tomato pulp, one-fourth corn or tiny lima

beans, and one-fourth okra, with seasoning added. One slice of onion 2 inches in diameter should be added to each No. 2 can. The tomatoes should be heated, rubbed through a sieve, and cooked down to about the consistency of ketchup before measuring; then the corn, okra, onion, and seasoning should be added and cooked until the corn and okra are about three-fourths done. Then pack into cans and follow directions as given in the table below. Net weight appearing on label of No. 2 can should be 1 pound 4½ ounces.

STANDARDS FOR 4-H BRAND CANNED FRUITS.

Figs.—The net-weight contents of a No. 2 enamel-lined can of figs should, as shown on the label, be not less than 1 pound 6 ounces. Figs should remain whole and a No. 2 can should contain about 30 to 35 whole figs.

Peaches.—A No. 3 can should have at least 1 pound 5 ounces solids (from 10 to 12 halves of peaches) and 11 ounces liquid, and the net weight appearing on label should be not less than 2 pounds.

Pears.—The net weight in a No. 3 can should be not less than 2 pounds, having 11 ounces liquid, 1 pound 5 ounces solids (from 12 to 14 halves of pears).

Berries.—The net weight of a No. 3 can of blackberries or raspberries should be 2 pounds; of a No. 2 can, 1 pound 6 ounces; whole berries weighing about one-half of total in each case. The berries should be large, whole, and of good color and flavor. The sirup used in packing must be made out of strained berry juice and sugar, with no water added. Enamel-lined cans always should be used.

TIME-TABLE FOR CANNING VEGETABLES.

[Do not attempt to use this table without reading all directions carefully.]

HOT-WATER PROCESS.

Vegetable.	Blanch, minutes.	Liquor.	No. of can.	Exhaust, minutes.	Process.
Asparagus	3 to 4	Brine (heavy)	2	3	Intermittent or 2 hours.
String beans	3 to 8	Brine	2	3	Do.
Do		do	3	5	Intermittent.
Lima beans	2 to 5	Salt, sugar, water.	2	3	Do.
Beets	Cook ¾ done, peel	Brine	2	3	1 to 2 hours.
Carrots	Cook ¾ done, scrape	do	2	3	1 hour.
Corn	1 to 3 (blanch on cob)	Salt, sugar, water.	2	10	Intermittent.[1]
Okra	6 to 8	Brine	2	3	Do.
Peas	3 to 5	Salt, sugar, water.	2	3	Do.
Peppers	Roast	Omit	1	3	25 minutes.
Do	do	do	2	3	30 minutes
Potatoes, sweet	Steam ¾ done, peel	Pack dry	3	15	3 to 5 hours.
Rhubarb		Cold water	2	2	15 minutes.
Soup, concentrated vegetable		Salt, sugar	2	5	2 hours.
Do		do	3	5	Intermittent.
Spinach	4	Brine	2	3	1 to 2 hours.
Tomatoes		Salt, sugar	2	2	20 minutes.
Do		do	3	3	25 to 30 minutes.
Vegetable mixture		Brine			Intermittent or 2 hours.

[1] See recipe.

Time-table for canning vegetables—Continued.

STEAM PRESSURE.

Vegetable.	Process.	Temperature.	Pressure.	Vegetable.	Process.	Temperature.	Pressure.
	Minutes.	° *F.*	*Pounds.*		*Minutes.*	° *F.*	*Pounds.*
Asparagus	30	240	10	Peas	45	240	10
String beans No. 2.	45	240	10	Soup, concentrated vegetable	30	250	15
String beans No. 3.	55	240	10	Spinach	30	228	10
Beets	30	228	5	Sweet potato	70	250	15
Corn	80	250	15				
Okra	30	240	10				

NOTE.—String beans packed in No. 2 cans are preferable because more surely sterilized.

Corn, lima beans, and peas should never be packed in larger container than No. 2. Corn is cut from cob after blanching.

The brine used is made of 2½ ounces salt to 1 gallon of water, except for asparagus, which contains 4 ounces to 1 gallon.

Beets and rhubarb when packed in tin must be put in enamel-lined cans.

Process pints as for No. 2 cans; quarts as for No. 3 cans, adding 10 minutes to each period.

String beans when more mature should be processed at 15 pounds pressure for 30 minutes for No. 2, and 45 minutes for No. 3.

TIME-TABLE FOR CANNING FRUITS.

Fruit.	Blanch.	Sirup.	In tin.			In glass.	
			No. of can.	Exhaust minutes.	Process, minutes.	Jar.	Process, minutes.
Apples	1 minute	No. 1	3	2	8	Quart	12
Berries		No. 3	2	2	10	...do...	12
Cherries, sweet	15 seconds	...do...	2	2	20	...do...	25
Cherries, sour	.....do.....	No. 4	2	2	20	...do...	25
Currants		No. 3	2	2	15	...do...	15
Figs	Soda blanch	...do...	2	2	25	...do...	30
Gooseberries		...do...	2	2	15	...do...	20
Guava	15 seconds	No. 4	2	3	20	...do...	25
Do	.....do.....		3	3	25	Pint	25
May haw		No. 3	2	2	20	Quart	25
Peaches	15 seconds	No. 4	3	3	15	...do...	20
Pears	.....do.....	No. 3	3	3	20	...do...	25
Plums	Prick with needle	No. 4	2	2	12	...do...	15

NOTE.—Berries, cherries, currants, figs, gooseberries, May haws, and plums when packed in tin must be put in enamel-lined cans.

To make the sirups recommended, boil sugar and water together in the proportion given below until sugar is dissolved. Strain all impurities out of the sirup before using:

Sirup No. 1, use 14 ounces to 1 gallon water.
Sirup No. 2, use 1 pound 14 ounces to 1 gallon water.
Sirup No. 3, use 3 pounds 9 ounces to 1 gallon water.
Sirup No. 4, use 5 pounds 8 ounces to 1 gallon water.
Sirup No. 5, use 6 pounds 13 ounces to 1 gallon water.

The sirup for canned berries is made out of berry juice instead of water.

Cook figs in sirup before packing.

JAMS, FRUIT BUTTERS, AND MARMALADES.

Jams are made of small fruits which are not whole or firm enough to use for preserves. No attempt is made to retain the original shape of the fruit, the finished product having a uniform consistency. Marmalades have a more jellylike texture and thin slices of the fruit appear suspended throughout the mixture. In fruit butters and pastes frequently less sugar is used than in jams and the product is more concentrated. Conserves may be made of large or small fruits, cooked in the same manner as jams. Sometimes nuts are added.

With jams, preserves, and jellies, it is advisable to use a chemical thermometer, Centigrade reading ranging from 0° to 110°, which, having fewer figures than a Fahrenheit instrument, is more easily read. The stem of this instrument should be 12 or 14 inches long, so that the reading will appear far enough above the surface to be easily seen. Fahrenheit readings given in recipes are approximate.

Well-glazed, hermetically sealed stoneware jars (fig. 15), with capacity of 8 oz. and up, are suitable and attractive containers for packing jams, marmalades, relishes, and pickles.

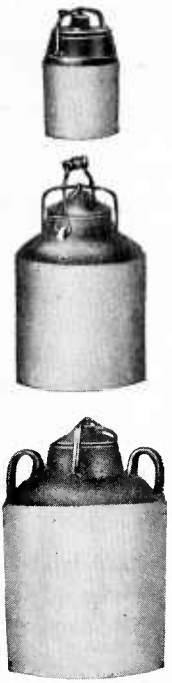

FIG. 15.—Hermetically sealed stoneware jar, three sizes.

Jams and marmalades may be packed hot in hot jars and sealed immediately. When packing for market, however, it is far safer to process them both to insure a tight seal. Process pints for 30 minutes at simmering, 188° F. (or 87° C.).

*Apple butter.—Measure the apples, wash to remove dirt, slice into small pieces, and for each bushel of apples add 4 gallons of water; boil until the fruit is soft, then rub through a screen or sieve.

To the pulp from each bushel of apples add 2 gallons of cider that has been concentrated to one-half its original volume. Bring to a boil and add 12 lbs. of sugar. Continue the cooking and just before the consistency desired for finished apple butter is reached add spices, cinnamon, and cloves according to taste. When the butter is as thick as desired, place in hot containers and seal immediately.

Berry jam.—In selecting berries for jam the ripe, broken ones will give fine color and flavor, but about one-half the quantity should be slightly underripe. This is necessary to give a jelly-like consistency to the product. Cooking in small quantities also helps to retain color and flavor. Weigh the berries and allow three-fourths of a pound of sugar to each pound of fruit. Rapid cooking with constant care is essential.

In stirring jam use a wooden spoon or paddle, moving it across the center of the vessel first one way and then the opposite and next around the pan, gently moving the mixture from the bottom of the pan, being careful not to stir rapidly or beat. Cook the jam to 105° C. or 221° F. When finished it will give the same test as required for finished jelly; that is, when a little is held a moment and cooled in a spoon, it will not pour from the side of the spoon but will flake off in a sheet. Pack and seal while hot.

Fig jam.—Select very ripe figs, remove all stems, treat them with

* Recipes marked with an asterisk were furnished by the Carbohydrate Laboratory of the Bureau of Chemistry.

scalding soda solution, and rinse thoroughly. (See Fig Preserves, p. 35.) Cook in quantities not larger than 3 lbs. at one time. Allow 1½ lbs. sugar to each 3 lbs. of figs. Add barely enough water to start the cooking (about one-half cup), crush the figs, heat to boiling, and add the sugar. Cook rapidly to 105° C. or 221° F., following instructions given under Berry Jam, p. 29. Pack and process at simmering for 30 minutes.

Guava paste.—Wash the guavas, remove blossom end, and cut into small pieces. Add sufficient water to start cooking without burning, cook until very soft, rub through a sieve; a flour sifter may be used successfully. Measure the part which has passed through the sieve and for each cup of guava add one-half cup of sugar. Continue the cooking (stirring constantly to prevent burning) until the excess of water is driven off, which is recognized by the manner in which the mixture leaves the pan on stirring. Remove from the fire, pour on a marble slab or on paraffin paper, and when cold cut into slices and pack in a box lined with paraffin paper.

Peach jam.—

2¼ lbs. peaches cut into small pieces.
1 lb. sugar.
6 whole allspice.
1 cracked peach seed.
1 inch ginger root.
½ c. peach juice.
½ tsp. whole cloves.
1 tsp. cinnamon bark.
1 sprig mace.

(Tie spices in cheese-cloth bag.)

Cook all together until thick as marmalade and clear (to 105° C. or 221° F.). Pack hot in hot jars and seal at once or process.

***Citrus fruit marmalade** (three-day method).—1 grapefruit; 1 orange; 1 lemon. Wash fruit and then cut very thin through pulp and rind, discarding all the seeds. Weigh the fruit and to each pound of the fruit add 3 pounds of water. Let stand overnight. Next day boil for 30 minutes and let stand for 24 hours. Next day measure or weigh the fruit and for each pound or portion of fruit juice add 1 lb. or portion of sugar. Bring to a boil and cook until it jellies, stirring so as to keep from burning. Place in glasses or jars while still hot, allow to cool, and then cover with paraffin.

***Sweet orange or grapefruit marmalade.**—Wash the fruit, weigh the peel and discard one-fourth of it, and note the weight of edible portion plus remaining peel. Place peel in water, boil for five minutes, and pour off water. Again cover peel with boiling water and allow to simmer over the fire until tender. Pour off water and add cold water to harden the peel. Then cut into as thin slices as possible. Place edible part of the orange or grapefruit in a kettle with twice the amount of water as of fruit and boil until the pulp has disintegrated. Strain through a muslin or cheese-cloth bag, and for

each pound of the edible portion and shredded peel add 1 lb. sugar. Boil until the jellying point is reached.

*Sour orange marmalade.—(Native fruit similar to the Seville orange.)

1 lb. peeled sour oranges.
2 lbs. water.
1½ lbs. sugar.

Preparation of the peel: Wash fruit, remove peel; discard one-fourth of the peel, using the portion free from blemish. Cut this peel into as thin slices as possible, place in a kettle with four times its weight of water, boil for 10 minutes, and drain free from water. Repeat this process three times.

Preparation of the juice: After the peel has been removed, weigh the fruit, cut into small pieces, place in a kettle, and for each pound of orange add 2 lbs. water. Boil until it thoroughly disintegrates. Pour into a flannel jelly bag and press until no more juice can be obtained. Again drain juice through a clean flannel jelly bag without pressing.

Pour this juice into a kettle, add the peel, bring to a boil, add 1½ lbs. sugar for each pound of fruit, and continue the boiling until the jelly stage is reached, which is indicated by the flaking or sheeting from the spoon. Cool, pack and seal.

Grape jam.—Select grapes about one-half of which are underripe rather than entirely ripe. Wash and stem the fruit. Separate the pulp from the skins. Cook pulp for 10 minutes and press through a sieve or colander to remove seeds. Add three-fourths cup of water to each quart of skin and boil until tender. Then put the pulp and skins together and measure. For every quart of the mixture use 1 lb. of sugar. Bring the fruit to a boil, add the sugar, and cook, stirring frequently until it will give the jelly test or reaches 105° C. or 221° F. Pour while hot into hot jars and process as for jam.

Gingered pears.—Use pears not quite ripe, peel, core, and cut into thin slices. To 8 lbs. of pears, allow 6 lbs. sugar, 1 cup of water, and the juice of 4 lemons. Cut the lemon rinds into thin strips and add them. Also add one-eighth pound of ginger root cut into pieces. Simmer until thick as marmalade. Pack like peach jam.

Damson plum conserve.—

4 lbs. plums.
3 lbs. sugar.
1 lb. shelled nuts.
2 oranges.
1 lb. raisins.

Remove the seeds and chop the plums. Peel the oranges and slice thinly one-half of the peel. Discard the other peel and the seeds. Mix chopped plums, orange pulp, sliced peel, sugar and raisins. Cook all together rapidly until bright and thick as jam. Add nuts

5 minutes before removing from the fire. If a thermometer is available, cook to 102° C. or 215° F. Add the nuts and cook to 103° C. or 217° F. Remove from fire, cool, and pack into jars.

Figs, after treating with soda as for preserves, may be made into conserve by this method.

Fruit pastes, as they are called, consist of boiled-down fruit pulp with sugar added according to the acidity of the fruit, and are improved in flavor if several varieties of fruit are mixed. After the fruit paste is made (see recipes), it can be colored red, yellow, or green with harmless vegetable colors. The coloring is stirred into the boiling mass after removing from the fire. Different flavors also can be added at this stage if desired. The paste is poured up in a half-inch layer on flat dishes, marble, or glass slabs, which are first rubbed with a cloth dipped in a good salad oil. The dishes are then exposed to draft for a couple of days, after which the paste is cut into figures. If the paste is well boiled down it is dried more easily. (Many small forms useful for cutting the paste can be had on the market.) The paste can also be cut with a common knife or with a fluted vegetable knife, or it can be cut in round cakes, the center of which is again cut with a smaller circular cutter; there will thus be both rings and small round cakes. The cut paste is placed on paper, sprinkled with crystallized sugar or common granulated sugar. Then it stands again a couple of days exposed to draft, is dipped in crystallized sugar, and packed in a tin or wooden box lined with parchment paper and with layers of the same paper placed between the layers of paste.

The paste can be kept thus and served as dessert, and as garnishing on creams and custards, frozen creams, large cakes, etc.

Apricot paste.—1 lb. powdered sugar to 1 lb. fruit pulp. Rub the fruit pulp through a purée strainer and weigh it. Add the sugar, put it over a slow fire, and cook until very thick, so that when a spoon has been passed through it the mass does not run together immediately. Then pour the paste upon flat dishes which have been rubbed with oil and allow it to dry. Cut and pack in layers as directed above.

In the same manner raspberry, strawberry, and currant pastes are made.

Quince paste.—¾ lb. powdered sugar for each pound of fruit pulp. Wipe the fruit, cut into quarters, remove flower and core, and cook in water until very tender. After rubbing the pulp through a sieve, weigh it and add the required amount of sugar. It is then cooked until very thick. Scalded and chopped nut kernels may be added. The pulp remaining after the juice has been extracted for quince jelly may be used also.

Gooseberry paste.—1 lb. powdered sugar for each pound of fruit pulp. Use part ripe and part slightly underripe berries. Cook as previously described. This paste may be colored before it is poured out. Different flavors also can be added to the gooseberry as well as chopped or sliced almonds or other nuts.

Apple paste.[1]—½ lb. powdered sugar to 1 lb. pulp as rubbed through a sieve. For this product apples that are of lower grade than is required for some other purposes can be used. Cut the apples into quarters. Remove flower, stem, and core. Put fruit into cold water until it is ready to be cooked. Boil tender under cover and over a very low fire in order not to scorch. Rub the tender apples through a coarse sieve, weigh, and put in the kettle to be cooked with the sugar under constant stirring until it is rather firm. It can be varied in taste by adding different flavors, as, for instance, vanilla, peppermint, or orange flavor, or cooked with either finely cut citron, finely cut lemon peel, or blanched and cut nut kernels. The paste is poured out, dried, and kept as the others.

Other fruit pastes can be made of cherries, plums, kumquats, guavas, and other tropical fruits.

It is often advisable to make several different pastes. When nearly dry (before cutting) place different colored or different flavored layers on top of each other as in a layer cake. With a sharp knife cut in one-half-inch strips through all layers and dry.

Tomato paste.—

1 quart thick strained tomato pulp.	1 slice onion.	1 tsp. sugar.
4 tbsp. chopped sweet red pepper pulp, or 1 tsp. paprika.	½ tsp. salt.	1 tbsp. mixed spices.

Cook spices, tied in bag, with tomato pulp in a pan over boiling water for about three hours, or until the paste is thick enough to hold the shape of spoon when tested by dipping out a spoonful. Pack hot, process small jars 15 minutes in water bath at 212° F.

PRESERVING.

A preserve is the product resulting when whole fruits are cooked in sirup until clear and transparent. When properly made the fruit in the preserve keeps its form, is plump, tender, clear, and of good color, the surrounding sirup being also clear and of proper density.

In making preserves the object is to have the fruit permeated with the sirup. It is well known that if two liquids of different densities be brought into contact with each other they tend to mix or diffuse until they equalize each other and become of the same density. This diffusion takes place through the cell walls of fruit or vegetables as readily as if they were not present between the fruit juice and the denser liquid. If fruit were placed at once in a very heavy sirup the difference in density between the two liquids would be so great that the sirup would absorb the fruit juice rapidly. This

[1] The recipes for the fruit pastes were furnished by Mr. Frants P. Lund.

would cause the fruit to shrink and become shriveled and toughened. The sirup could then enter the fruit with great difficulty. In order to prevent shrinkage it is necessary to put fruit at first into this sirup and increase its density slowly enough for diffusion to take place and for the fruit to be permeated with the sirup. This is done by boiling the fruit in sirup or by alternately cooking and allowing the product to stand immersed in the sirup, the density of the sirup being increased by evaporation or by substituting a heavier sirup for the lighter one after each period of standing. If at any time the fruit shrivels or wrinkles the sirup should be made less dense by the addition of water. If this process be carried on gradually enough the fruit may be completely saturated with sugar (as is the case with crystallized products) without shrinking.

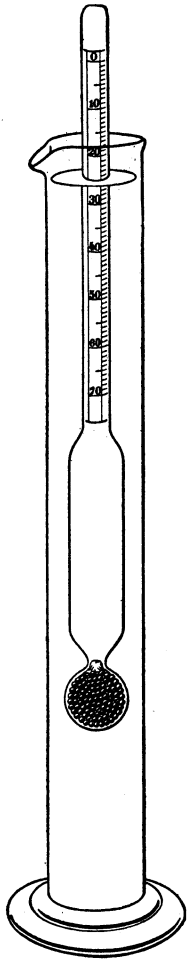

FIG. 16.—Saccharometer and cup.

In order to measure the density of liquids accurately and proceed with certainty, instruments called hydrometers have been devised. The one for the special purpose of measuring the density of sugar solution is known as a saccharometer. The saccharometer shown in illustration (fig. 16) is a shot-weighted glass spindle graduated from 0 to 70 degrees, a Balling scale being used. When placed in water the spindle rests on the bottom of the vessel and the reading at the surface is zero. As the density is increased the spindle rises until when the solution is saturated with sugar at the temperature indicated the reading is 100. This saccharometer is inexpensive and is accurate enough for ordinary use. The Brix scale has the same gradations of density as the Balling, but is slightly more accurate, and costs more. It may be secured mercury-weighted. In using a saccharometer it is necessary to have a vessel of the same depth in which to float it to make the reading. This must be very narrow in order not to demand so large a quantity of sirup to measure its density. A 250-cubic-centimeter glass cylinder or a brass saccharometer cup is used.

For fruits like peaches, pears, watermelon rind, etc., preserving should be begun in sirup not heavier than 30° Balling (No. 3 in table, p. 15). Juicy fruits like berries can be put at the beginning into a heavier sirup, about 40° Balling, because the abundant juice of the fruit quickly reduces the density of the sirup before shrinking can take place. Finished preserves are packed in a sirup ranging

from 50° to 60° Balling. Sirup made with very acid fruits can be made heavier than pure sugar sirups without danger of crystallization because the acid inverts some of the sugar, changing it to a form which will not crystallize readily.

Since long cooking injures the color and flavor of fruits, it is desirable to cook delicate fruits such as berries for as short a time as possible. Cooling rapidly after cooking gives preserves a better color and flavor than can be secured when they are packed hot. Standing immersed in sirup after cooking also helps to plump them. If berry preserves are covered for a brief time before removing from fire and the vessel left covered while cooling the product will be more plump.

For cooling, shallow enamel trays or pans are desirable. Tin can not be used because fruits will discolor in it. Pack preserves cold, bring the sirup in which they have stood to boiling, test, and if of proper density pour over the packed preserves, paddling to remove all air bubbles. If not of the right weight for packing, the sirup must be concentrated by boiling. To seal properly and to insure safety from mold it is necessary to process all preserves. Since they can be safely processed below the boiling point, processing at simmering for 30 minutes is preferable to boiling, because this temperature will give better color.

Fig preserves.—6 qts. figs; 2 qts. sugar; 3 qts. water. Put the figs into a boiling soda solution (1 c. soda to 6 qts. of boiling water) and allow figs to remain about 5 minutes. Rinse the figs well by putting them through two cold baths. Drain the fruit thoroughly and add gradually to the skimmed sirup, which has been made by boiling the sugar and water together for 10 minutes. Cook rapidly until the figs are clear and tender (about 2 hours). Carefully lift the fruit out and place in shallow pans. Cover the figs with the sirup and allow to stand overnight. Pack the cold figs in hot jars, fill each jar to overflowing with the sirup. Cap, clamp, and process (fig. 17).

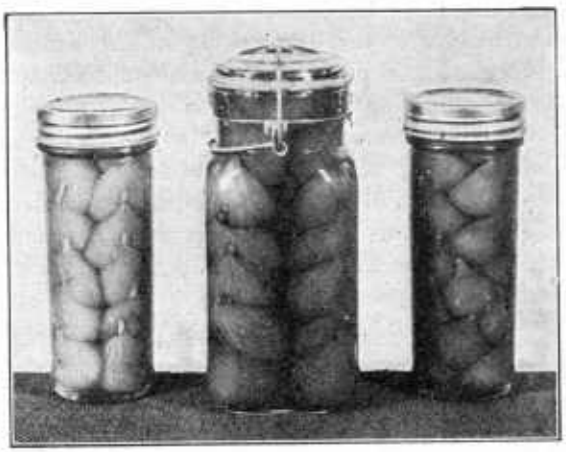

FIG. 17.—Standard packs of fig preserves.

Strawberry preserves.—2 lbs. berries; 1½ lbs. sugar; 1 c. berry juice. Pick over the fruit

and put together all firm, perfect berries. Slightly heat, crush, and strain the others to obtain the juice. Make a sirup of the sugar and juice, bring to the boiling point, remove from the fire, and cool before adding the berries. Add the berries a few at a time. Place again over the fire and heat slowly to boiling. Cook rapidly to 106° C. or 223° F. If a thermometer is not at hand, cook until berries are bright and transparent. Cool and pack cold in jars, which have been previously boiled. Process at simmering temperature (87° C. or 188° F.) to give best results in color and flavor. For 12-oz. or pint jars at this temperature, process for ½ hour. Other berries may be preserved in the same way.

Watermelon preserves.—Cut 1 lb. watermelon rind into inch squares. Allow to stand overnight in salt water (4 tbsp. salt to 1 qt. water). Drain, freshen in clear cold water for 1 hour, drain and cover with a 30° sirup (2 c. sugar to 1½ qt. water). Boil for 25 minutes. Let stand immersed in sirup for several hours. Add juice of ½ lemon and three slices of lemon additional for each pound. Cook until transparent (about 1 hour). Let stand until cold. Pack, add the sirup, garnishing with slices of lemon, cap, and process.

Gingered watermelon rind.—To each pound of rind cut into 1-inch squares add 2 qts. of water and 1 oz. slacked lime. Let stand in lime water overnight. Next morning drain and let stand 1 to 2 hours in fresh cold water. Drain well and boil rapidly in strong ginger tea (1 oz. ginger to 1 qt. water) for 15 minutes. Drain, put into a 30° sirup made by using 1 pt. strained ginger tea with 1 qt. water and 1½ lbs. of sugar. Cook until tender and transparent (about 1½ hours). After boiling a half hour add half a lemon sliced thin. Place in shallow pans to cool, having the rind well covered with sirup. When cool pack, cap, clamp, and process.

Uniform products can be more easily obtained by using the saccharometer to test the density of the sirup. The packing sirup for preserved and gingered watermelon rind and figs should be of 55° density, Balling saccharometer.

Cherry preserves.—4 lbs. cherries; 3 lbs. sugar; 1 c. cherry juice. Make a sirup of the sugar and fruit juice, cool, add seeded cherries, and cook rapidly until fruit is clear and sirup is of the proper consistency. If a thermometer is used, finish cherry preserves at 106° to 108° C. or 223° to 226° F. Cool, pack into jars, and process as for other preserves.

JELLY MAKING.

A good jelly should be bright, of good color, and clear. When removed from the glass, it should retain the shape of the mold. The jelly can be cut with a distinct cleavage, retaining the angles where cut. It should sparkle and be tender enough to quiver without breaking.

Fruit for jelly making.—The juice from certain fruits, such as grape, apple, crabapple, orange, kumquat, and currant is better suited for making a natural fruit jelly than juices from other fruits. The juices from these fruits contain the properties necessary for jelly making. The best fruits for jelly making contain pectin and acid. Pectin, the fundamental jelly-making substance, does not exist in some fruits in sufficient amount to make jelly without the addition of pectin from some other source. The peach, strawberry, and cherry are examples of fruits which contain acid but are lacking in pectin. Pear, guava, and quince contain pectin but are deficient in acid. If the missing property be added to each of these fruits, a jelly with the color and flavor of the fruit selected can be made.

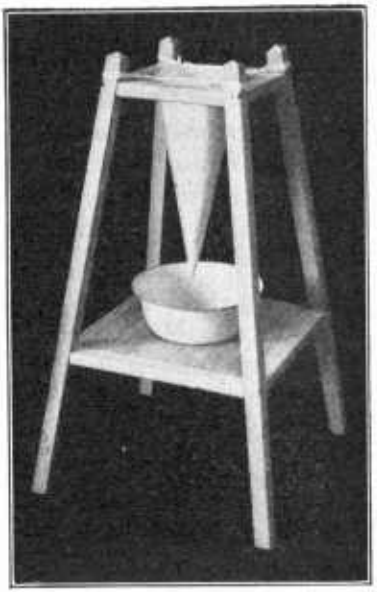

FIG. 18.—Jelly strainer.

Extracting the juice.—Wash such fruit as berries, grapes, and currants in running water and add 1 cup of water for each pound of fruit. For apples, quinces, guavas, and such hard fruits, wash, slice, and add 3 c. water to each pound of fruit. The fruit should be cooked until tender, a small quantity of water being added to help extract the juice. The fruit juice will flow more freely when heated than when cold, and the cooking develops the pectin. As soon as the fruit is tender the liquid should be squeezed through a cheese-cloth and then be allowed to drip, without pressure, through a flannel jelly bag (fig. 18). Overcooking of the fruit is apt to result in a cloudy jelly. After cooling the juice to room temperature test it to determine the amount of pectin present. This test gives some idea of the proper proportion of sugar to juice. Add 1 tbsp. 95 per cent. grain alcohol to an equal volume of cooled fruit juice and shake gently. The effect of the alcohol is to bring together the pectin in a jellylike mass. If a large quantity of pectin is present it will appear in one mass or clot when poured from the glass. This indicates that equal quantities of sugar and juice may be used. If the pectin does not slip from the glass in one mass, less sugar will be required. A fair proportion is ¾ c. of sugar to 1 c. of juice. If the pectin is thin and much separated, ½ c. of sugar allowed for each cup of juice will be sufficient.

Quantity of juice to cook.—The quantity of juice to be cooked at

one time will depend upon the size of the vessel and the methods of heating available. The capacity of the vessel used should be four times as great as the volume of juice to be cooked. If the attempt is made to cook a large quantity of juice at one time over a slow flame, there will be a loss of color and a decrease in the yield, partly due to the destruction of the pectin.

When to add the sugar.—When the proportion of sugar to juice has been determined, measure the fruit juice and place over the fire to cook. When the juice begins to boil, add the sugar immediately and stir until the sugar is dissolved. By adding the sugar when the juice begins to boil, more time is given for the inversion of the sugar by the acids of the fruit and there is less danger of crystallization.

Cooking the jelly.—After the sugar has dissolved, the cooking should be as rapid as possible. Finished jelly can be obtained more quickly by rapid cooking. Long cooking will tend to darken the product and destroy the pectin, which will cause the finished jelly to be less firm.

Testing for the finished jelly.—A thermometer can be used to great advantage to show when the jellying point is almost reached. (See description, p. 29.) No exact temperature can be given, because the jellying point differs with different fruits, with the quantity of sugar used, and with the same fruits at different seasons. In using a thermometer for cooking apple jelly it has been noted that the temperature is seldom less than 105° C. or 221° F. or more than 106° C. or 223° F. While the temperature for guava jelly is approximately 108° C. or 226° F., a temperature less than this will give a sirupy product. With grape and currant jelly, between 106° C. and 107° C. or 223° F. and 224° F. will give the best results.

Since no definite temperature can be given for the finished jelly, the most convenient means of determining when it is finished is to test it with a spoon or paddle. Dip a spoon or wooden paddle in the boiling mass. Remove and cool by moving it back and forth for a few seconds and then allow the jelly to drop from it. As long as there is sirup present it will run or drop from the spoon. When the jellying point is reached, it will break from the spoon in flakes or sheets. When this jelly stage is reached, remove from the fire immediately and skim. Skimming at this point saves waste.

Filling glasses.—After skimming the jelly, pour at once into hot glasses and set aside to cool.

Cooling and sealing.—Cool as rapidly as possible, avoiding dust which will give contamination with mold. When the jelly is cold cover it with melted paraffin. By running a pointed stick around

the edge of the glass while the paraffin is still hot, a better seal can be obtained.

Storing.—Jelly should be stored in a cool, dark, dry place. If jelly is stored for a long period of time, it will deteriorate in texture, color, and flavor.

Mistakes to avoid.—*Soft jelly.*—Jellies sometimes are sirupy because more sugar has been used than the fruit juices require or because boiling after the addition of sugar was not continued long enough to drive off excessive water.

Tough jelly.—Jelly is tough or stringy because too small an amount of sugar was used for the quantity of fruit juice taken or because the boiling was continued after the jellying point had been reached.

Crystals in jelly.—Crystals appear throughout the jelly because of an excess of sugar. When sugar is boiled with an acid for a sufficient length of time, it is changed into a form which does not crystallize. Crystals are found in jelly sometimes because the juice is boiled to too great a concentration before the addition of sugar, or in boiling the sirup spatters on the side of the pan, dries, and in pouring the finished product these crystals are carried into the glasses of jelly, and in that way the jelly becomes seeded with crystals.

Cloudy jellies.—This may be due to having cooked the fruit too long before straining off the juice or to not having used sufficient care in straining the juice. Sometimes it is noticed in apple and crab-apple jelly that although it is clear when first made, the jelly becomes cloudy after a time. In these cases it usually is due to the use of partly green fruit, the starch in this fruit probably causing the cloudy appearance.

Apple pectin.—

1 lb. apple pulp (or skins and cores).[1]
Juice of 1 lemon.
4 lbs. water.

Boil for ½ to ¾ hour, press the juice through a cloth bag, then allow this juice to drain without pressure through a heavy flannel or hair-cloth jelly bag. This juice when cold should be tested with alcohol to determine the proportion of sugar to add to a volume of juice. Pectin can be bottled, processed for 15 minutes in a water bath at boiling, and kept until needed for jelly making.

Orange pectin.—Cut or scrape the yellow rind from the peel of the orange, the white portion remaining being passed through the food chopper and weighed. For each pound of this prepared peel add 2 lbs. of water and 4 tbsp. of lemon juice, mix thoroughly, and allow to stand 15 minutes. Then add 2 lbs. water, boil 10 minutes, let stand overnight. Next morning boil 10 minutes, allow to cool, press to

[1] Only sound fruit should be used, not decomposed or worm-eaten fruit.

remove juice, and then drain juice through a flannel bag. If not desired for immediate use, bottle and process as for apple pectin.

Mint and orange (or apple) pectin jelly.—

1 pt. concentrated orange (or apple) pectin juice.
1 lb. sugar.
2 drops oil peppermint.
2 drops green vegetable coloring.

Bring the orange or apple pectin juice to boiling, add sugar, and boil rapidly until the jellying point is reached. At this point 2 drops of green vegetable coloring matter is added, together with 2 drops of oil of peppermint. Stir thoroughly, and pour while hot into clean, hot jelly glasses. After a few moments the scum which rises to the top may be removed from the jelly easily with a spoon. Cool and seal.

Strawberry and orange (or apple) pectin jelly.—

½ pt. concentrated orange (or apple) pectin.
½ lb. sugar.
½ pt. strawberry juice.

Mix orange (or apple) pectin juice and the strawberry juice, bring to a boil, and add sugar. Continue boiling until the jellying point is reached. Pour immediately into hot jelly glasses and skim. When cold, pour hot paraffin over the jelly.

Pineapple and orange (or apple) pectin jelly.—Add 1 pt. orange (or apple) pectin juice to 1 pt. pineapple juice which has been boiled for 10 minutes, add 1 lb. sugar, and continue boiling until the jellying point is reached. Pour immediately into hot jelly glasses and skim. When cold, pour hot paraffin over the jelly.

Apple jelly.—

1 lb. fruit.... } Boil together for ½ to ¾ hour and strain.
2 lbs. water.. }

One pint strained juice—determine amount of sugar to be added by the use of the alcohol test previously given—bring the juice to a boil, add the sugar and cook as rapidly as possible until the jelly point is reached. Remove from the fire, skim, pour into hot glasses, which have previously been boiled. When cold cover with melted paraffin.

Grape jelly.—

4 lbs. grapes.. } Crush and boil together for 20 minutes, press through a jelly bag,
1 lb. water... } and allow to drain through a flannel bag.

Test the strained juice with alcohol to determine the proportion of sugar to use. Bring the grape juice to boiling, add sugar, and stir until the sugar is dissolved. Continue the boiling until the jelly point is reached. Remove from the fire and skim. Pour into hot glasses, seal, and store.

Blackberry jelly.—

4 lbs. blackberries.
1 lb. water.

Select 3 lbs. of ripe fruit and 1 lb. of underripe fruit wash by running water over them, cap, crush, and add 1 pt. of water and boil 15 minutes. Press the pulp and strain the juice through a flannel bag. Determine the correct amount of sugar to be added by the use of the alcohol test. Bring the juice to a boil, add sugar, and stir until the sugar is dissolved. Continue the boiling until the jelly point is reached. Remove from the fire and skim. Pour into hot glasses, seal, and store.

Contributions to the information on jelly making have been made by Dr. M. N. Straughn, of the Carbohydrate Laboratory, Bureau of Chemistry.

The instructions given in this bulletin were prepared mainly with a view to canning for home use. If products are packed for sale the State Food Commissioner should be consulted as to the State regulations regarding such products, and if they are packed for interstate shipment additional information concerning the requirements under the Federal Food and Drugs Act should be secured from the Bureau of Chemistry of this Department.

INDEX.

[Numbers refer to pages.]

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